



## GLB1 gene

galactosidase beta 1

### Normal Function

The *GLB1* gene provides instructions for producing an enzyme called beta-galactosidase ( $\beta$ -galactosidase). This enzyme is located in lysosomes, which are compartments within cells that break down and recycle different types of molecules.

Within lysosomes,  $\beta$ -galactosidase helps break down certain molecules, including substances called GM1 ganglioside and keratan sulfate. GM1 ganglioside is important for normal functioning of nerve cells in the brain, and keratan sulfate is particularly abundant in cartilage and the clear covering of the eye (cornea). Keratan sulfate belongs to a group of large sugar molecules called glycosaminoglycans (GAGs) or mucopolysaccharides.

The *GLB1* gene also provides instructions for making the elastin-binding protein. On the cell surface, elastin-binding protein interacts with proteins called cathepsin A and neuraminidase 1 to form the elastin receptor complex. This receptor complex plays a role in the formation of elastic fibers, which are a component of the connective tissue that forms the body's supportive framework.

### Health Conditions Related to Genetic Changes

#### GM1 gangliosidosis

More than 80 mutations in the *GLB1* gene have been found to cause GM1 gangliosidosis. Most mutations change single DNA building blocks (nucleotides) in the *GLB1* gene. These mutations often affect the production of both  $\beta$ -galactosidase and elastin-binding protein.

*GLB1* gene mutations that cause GM1 gangliosidosis reduce or eliminate the activity of  $\beta$ -galactosidase. Without enough functional  $\beta$ -galactosidase, GM1 ganglioside and keratan sulfate cannot be broken down. As a result, these substances accumulate to toxic levels in many tissues and organs. In the brain, progressive damage caused by the buildup of GM1 ganglioside leads to the destruction of nerve cells, which causes many of the signs and symptoms of GM1 gangliosidosis.

Although the role elastin-binding protein plays in the development of GM1 gangliosidosis is unclear, the alteration of this protein may contribute to the weakened heart muscle (cardiomyopathy) found in some people with GM1 gangliosidosis.

## mucopolysaccharidosis type IV

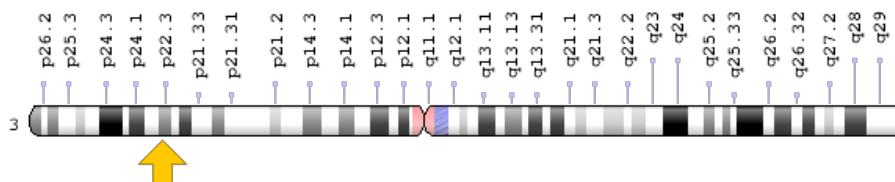
More than 10 mutations in the *GLB1* gene have been found to cause mucopolysaccharidosis type IV (MPS IV). Most of these mutations change single nucleotides in the gene. All of the mutations that cause MPS IV disrupt the breakdown of keratan sulfate by  $\beta$ -galactosidase. The degradation of GM1 ganglioside is not affected by these mutations.

The lack of  $\beta$ -galactosidase activity leads to the accumulation of keratan sulfate within lysosomes. Because keratan sulfate is predominantly found in cartilage and the cornea, the buildup of this substance causes skeletal abnormalities and cloudy corneas. Researchers believe that a buildup of GAGs may also cause the features of MPS IV by interfering with the functions of other proteins inside lysosomes and disrupting the movement of molecules inside the cell.

### Chromosomal Location

Cytogenetic Location: 3p22.3, which is the short (p) arm of chromosome 3 at position 22.3

Molecular Location: base pairs 32,996,608 to 33,097,230 on chromosome 3 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

### Other Names for This Gene

- acid beta-galactosidase
- beta-galactosidase
- beta-galactosidase isoform a preproprotein
- beta-galactosidase isoform b
- beta-galactosidase isoform c preproprotein
- BGAL\_HUMAN
- EBP
- elastin receptor 1, 67kDa

- ELNR1
- galactosidase, beta 1
- lactase

## **Additional Information & Resources**

### Educational Resources

- Essentials of Glycobiology (second edition, 2008): Degradation of Keratan Sulfate  
<https://www.ncbi.nlm.nih.gov/books/NBK1934/?rendertype=figure&id=ch41.f5>
- Madame Curie Bioscience Database: Defects in Glycosaminoglycan Degradation (Mucopolysaccharidoses)  
<https://www.ncbi.nlm.nih.gov/books/NBK6177/#A53462>
- Madame Curie Bioscience Database: Degradation of GM1 Ganglioside  
<https://www.ncbi.nlm.nih.gov/books/NBK6177/#A53458>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28GLB1%5BTIAB%5D%29+OR+%28%28beta-galactosidase%5BTIAB%5D%29+OR+%28acid+beta-galactosidase%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D>

### OMIM

- GALACTOSIDASE, BETA-1  
<http://omim.org/entry/611458>

### Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology  
[http://atlasgeneticsoncology.org/Genes/GC\\_GLB1.html](http://atlasgeneticsoncology.org/Genes/GC_GLB1.html)
- ClinVar  
<https://www.ncbi.nlm.nih.gov/clinvar?term=GLB1%5Bgene%5D>
- HGNC Gene Symbol Report  
[http://www.genenames.org/cgi-bin/gene\\_symbol\\_report?q=data/hgnc\\_data.php&hgnc\\_id=4298](http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=4298)
- NCBI Gene  
<https://www.ncbi.nlm.nih.gov/gene/2720>
- UniProt  
<http://www.uniprot.org/uniprot/P16278>

## Sources for This Summary

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